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CS/M.Tech(ECE)/SEM-2/MCE-204D/2011

2011

MICROWAVE MEASUREMENT TECHNIQUES

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer Questions No. 1 and any *four* from the rest.

1. Answer in brief any *seven* of the following : 7 × 2

   a) What is the main difference between a scalar network analyser and a vector network analyser ?

   b) What is meant by 'time in passband' in a spectrum analyser ?

   c) Why reflectometer technique is superior to slotted line technique of impedance measurement ?

   d) In a spectrum analyser, why is IF chosen above the highest frequency of tuning range ?

   e) What is minimum and maximum range of a pulse radar system ?

f) How is error due to gain variation avoided in a Dicke radiometer ?

g) What is Total Harmonic Distortion (THD) ?

h) If a transmission line of characteristic impedance (Z_o) is terminated with a load impedance $Z_L = \frac{1}{2} Z_o$ then what type of waveform will be obtained in a TDR display ?

i) Why amplitude modulation of a microwave signal is done for detection with a diode detector ?

j) What is the difference between an active and a passive microwave sensor ? Give one example of each.

2. Draw the block diagram of an RF powermeter using thermistor sensor and explain its principle of operation. What are the differences between a thermistor and a barretter ? 10 + 4

3. What is transfer oscillator technique of frequency measurement ? Draw the block diagram of a microwave frequency counter using transfer oscillator technique and explain its operation. 4 + 10

4. What are the advantages of an FM CW Doppler Radar over : (i) Pulse Radar and (ii) CW Radar ? Draw the block diagram of an FM CW Doppler radar and explain how range and velocity of a moving object can be determined with its help. 4 + 10

5. Draw the block diagram of a superheterodyne spectrum analyser and explain the function of each block of it. What is meant by frequency resolution of a spectrum analyser ? Which part of a spectrum analyser determines its frequency resolution and how ? 10 + 1 + 3

6. What is a Time Domain Reflectometer (TDR) and what are its applications ? Obtain the shape of reflected waveform when the load impedance Z_L consists of a resistor and an inductor in series. What will happen when inductance value is very small ? 4 + 8 + 2

7. Write note on any *one* of the following : 14

   a) Power meter using thermocouple sensor

   b) Impedance measurement using shift in minima method

   c) Vector Network Analyser.